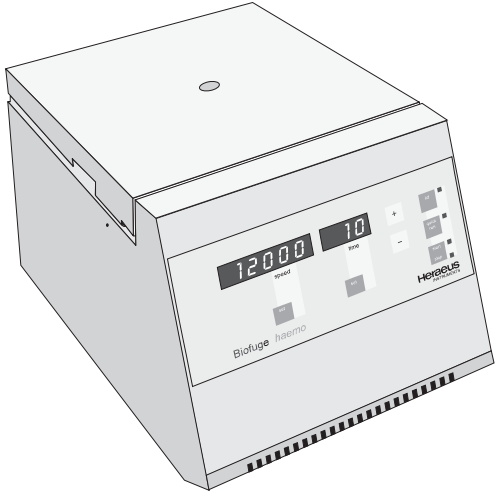
Heraeus

Biofuge *haemo*

Instructions for use



Kendro

How to use this manual

Use this manual to get acquainted with your centrifuge and its accessories.
The manual helps you to avoid inappropriate handling. Make sure to keep it always close to the centrifuge.
A manual that is not kept handy cannot provide protection against improper handling and thus against damage to persons and objects.
The manual comprises chapters on

- Safety regulations
- Instrument description
- Rotor program and accessories
- Transportation and hook-up
- Use of the centrifuge
- Maintenance and care
- Troubleshooting
- Technical data
- Index

Overleaf you will find a graphic representation of the control panel of the *Biofuge haemo* with a survey of the most important functions

Please fold out

12000
speed
set
10
time
set
+
–
lid
quick run
start
stop
Biofuge haemo
Heraeus

The control panel of the *Biofuge haemo*

Display

Speed

Resting state:	upon pressing any key: display of preselected speed, after 2 min switch to standby mode (flashing red light)
During run:	preselected speed
Braking:	"br"
End:	"0"
Lid open:	"OPEN"
Resting/end:	error codes (if present)

Run time ("time")

Resting/end:	upon pressing any key: display of preselected run time, after 2 min switch to standby mode (flashing red light)
During run:	remaining run time or (with quick start) run time passed

Keys

lid:	open lid (only possible if connected with mains supply)
quick run:	short-term acceleration as long as key is pressed, with indication of run time passed
start/stop:	normal start or manual stop
set speed/time:	selection of the parameter to be changed (speed or run time)
+/-	stepwise increase/decrease of preset values for the selected parameter speed or run time, accelerated change when pressed permanently

Error codes
(troubleshooting see chapter "Troubleshooting")

E-1/E-12:	keys do not respond (main board defective)
E-3:	no braking current: lid popped open or manually opened during run; excess temperature in the drive
br:	power turned off during run or power failure
lid:	lid opened during run
OPEN:	lid lock mechanism out of order

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For your safety

Heraeus centrifuges are manufactured according to current technical standards and regulations. Nonetheless, centrifuges may pose dangers if

- they are not used as designed
- they are operated by untrained personnel
- their design is improperly changed
- the safety instructions are not heeded

Therefore anybody concerned with operation and maintenance of the centrifuge must read and follow the safety instructions.

In addition, the pertinent regulations for prevention of accidents must be strictly followed.

This manual is an integral part of the centrifuge assembly and must be kept close at hand at all times.

Proper use

The centrifuge is designed to separate liquid-suspended materials having different densities and particle size, respectively. The maximum sample density is 1.2 g/cm^3 at maximum speed.

Improper use

During a run, a safety zone of 30 cm around the centrifuge must be maintained where neither persons nor hazardous materials may be stationed.

The centrifuge may cause harm to you or other persons and may damage material goods if you do not respect the following safety measures:

Centrifuging hazardous materials

- The centrifuge is neither made inert, nor is it explosion-proof. Therefore never use the centrifuge in an explosion-prone environment.
- Explosive or flammable substances must not be centrifuged. The same holds for substances prone to react briskly with each other.

- Do not centrifuge toxic or radioactive substances or pathogenic microorganisms unless you have taken proper precautions.
  Such precautions can e.g. consist of biological seals.
- Should toxins or pathogenic substances enter the centrifuge or its parts, you must carry out the proper procedures for disinfection (see "Maintenance and care – Disinfection").
- Strongly corrosive substances that may cause damage to materials and impair the mechanical strength of the rotor may be centrifuged only inside protective vessels.

Handling

- Never use the centrifuge unless the rotor is properly mounted.
- Never manually open the lid if the rotor still turns.
- Use only original parts for the centrifuge. The only exception are common glass or plastic centrifuge tubes if these are approved for the rotor speed and RCF values of your rotor, respectively.
- Never use the centrifuge with the lid open.
- Never use the centrifuge if the paneling has been partially or totally removed.
- Changes in mechanical or electrical components may be carried out only by persons authorized to this effect by KENDRO Laboratory Products.
- You may use the centrifuge only with a properly loaded rotor. You must not overload the rotor.
- If the rotor or the lid shows visible traces of corrosion or wear, you must stop using it.
- Strictly follow the rules and regulations for cleaning and disinfection.

Conformity to current standards

Heraeus centrifuges are manufactured and tested according to the following standards and regulations:

CE

for all voltages:

- IEC 1010-1 / EN 61010-1
- IEC 1010-2 / EN 61010-2-020
  - Pollution degree 2
  - Overvoltage category II

for 120 V only:

- CAN/CSA-C22.2 No. 1010.1-92
- CAN/CSA-C22.2 No. 1010.2.020-94

Safety instructions in this manual

This symbol denotes potential hazards to persons.

This symbol denotes potential damage to the centrifuge or parts in its immediate surroundings.

General hints are marked with this symbol.

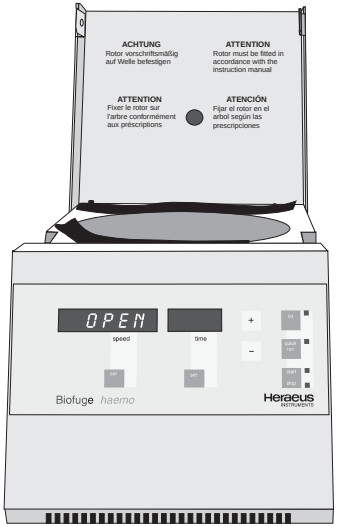
In addition, you are asked to adhere to the pertinent regulations, in Germany

- Regulations for prevention of accidents VBG 4
- Regulations for prevention of accidents VBG 5
- Regulations for prevention of accidents VBG 7z

for your notes

The Biofuge haemo

The figure below shows the *Biofuge haemo* with the lid opened. In this state, the standard display at the end of a run and after opening the lid is "OPEN". After a couple of minutes the display changes to the standby mode, and all display panels turn dark.



Safety systems

The *Biofuge haemo* is equipped with a number of safety systems.

Rotor chamber

The rotor chamber is integrated into the steel case. When the lid is closed, the rotor chamber is sealed against the surroundings by a rubber ring with a special profile that allows cooling air to pass through the rotor chamber.

Warning if lid is manually opened during a run, or if lid lock mechanism is out of order

If the lid is manually opened during a run, or if the lid lock mechanism is out of order, a corresponding message appears in the display ("Lid" and "OPEN", respectively).

Lid lock mechanism

You can open the lid only when the power is turned on and the rotor has practically come to a halt (< 80 rpm). You can start the centrifuge only if the lid is properly closed.

Emergency lid release

In order to permit you to remove samples even after a power failure, the centrifuge is equipped with an emergency lid release (see „Operation“).

Properties

The *Biofuge haemo* is an air-cooled benchtop centrifuge for the determination of the hematocrit.
It can also be used for the preparation of sensitive samples in the biochemical and medical laboratory. The rotor accepts common centrifuge tubes up to a volume of 2 ml.
The preset speed is reached in seconds. You can also spin samples for only a few seconds using the "quick run" key if this is required for the task in question. The long-lived, maintenance-free induction motor provides quiet and vibration-free operation even at high speeds.
The user-friendly control panel permits easy operation. At the start the preset speed and run time are displayed. During a run, the remaining run time is displayed: above 1 min in minutes and below 1 min in seconds.
If you press the "+" or "-" key repeatedly, you increase the corresponding preset parameter (speed or run time) stepwise. If you press and hold down the chosen key, the respective value changes continuously, at first slowly and after a few seconds at an accelerated pace.

Air cooling of the *Biofuge haemo*

During a run, the spinning rotor creates frictional heat. This leads to a temperature increase of the rotor, the tubes and finally of the samples. The extent of warming depends on:

- run time
- temperature of the environment
- location of the centrifuge
- rotor speed

The *Biofuge haemo* is equipped with air cooling to prevent overheating of the samples. The cooling is particularly effective in the cold room (lowest permissible temperature +4 °C).

"Quick run" operation

If you press and hold the "quick run" key, the rotor is accelerated with maximum force up to the maximum speed.

Accessories

Standard accessories

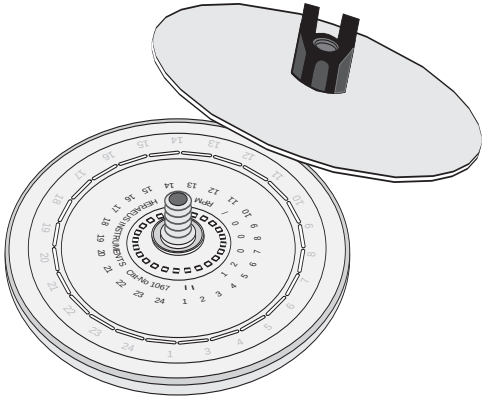
Hematocrit dish and reading harp

The *Biofuge haemo* is delivered with a special rotor (hematocrit dish or rotor) equipped with 24 guide notches for receiving blood capillaries.

A reading harp for determining hematocrit values after removing the capillaries is delivered with the instrument.

Reading spiral

As an option, you can order a reading spiral which is placed directly onto the rotor for reading hematocrit values *in situ.*



Hematocrit rotor

Table 1: Hematocrit rotor order. no. 7500 1067 for biofuge haemo

number of samples	24 blood capillaries
temperature range	-4 °C to +40 °C
maximum capacity	24 capillaries with 1.2 to 1.8 mm diameter and 75 + mm length
maximum speed n_{max}	12000
maximum RCF value at n_{max}	14926

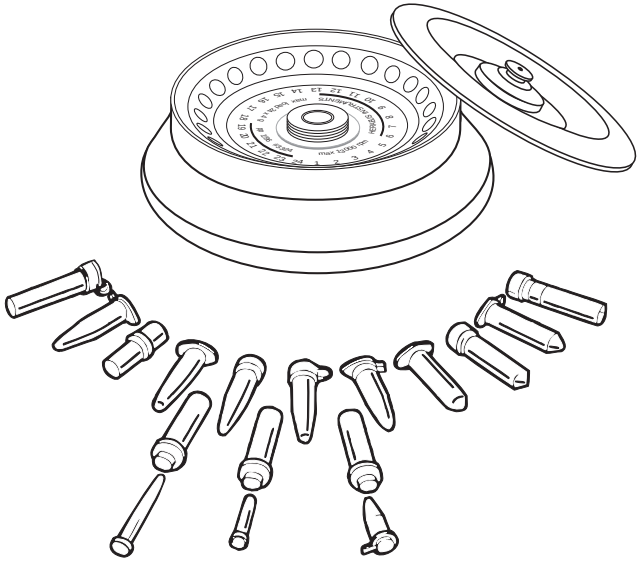
Additional accessories

Fixed-angle rotor 7500 3325 for microliter tubes

Optionally you can order for the *Biofuge haemo* a fixed-angle rotor with 24 holes for placing microliter tubes with a volume of 1.5 or 2.0 ml.

In addition, three sets of adapters with 24 reduction sleeves each are available on request. With the adapters you can centrifuge all commercially available microliter tubes with volumes of 0.2 ml to 0.6 ml as well as 0.2 ml PCR reaction vessels.

Please refer to our sales documents for detailed information on accessories including technical data and order numbers.



Fixed-angle rotor: technical data

Table 1: Fixed-angle rotor order no. 7500 3325 for Biofuge haemo

no. of places/volume		24 x 1.5 / 2 ml
maximum permissible load		24 x 4 g
temperature range		-4 °C to +40 °C
maximum speed n_{max}	[min^{-1}]	13000
maximum RCF value at n_{max}		16060
minimum speed n_{min}	[min^{-1}]	2000
minimum RCF value at n_{min}		380
maximum radius	[cm]	8.5
minimum radius	[cm]	5.9
angle of incidence		40°
maximum kinetic energy	[s]	1.65 kNm

Adapters for rotor order no. 7500 3325

Table 2: Adapters for the fixed-angle rotor *of the* Biofuge haemo

Adapter	Dimensions (∅ x H)	Capacity	Number per Set	Color	Order No.
reduction sleeve PCR	6,2 x 20 mm	0.2 ml	24	gray	7600 3750
reduction sleeve	8 x 43.5 mm	0.5 / 0.6 ml	24	turquoise	7600 3758
reduction sleeve	6 x 46 mm	0.25 / 0.4 ml	24	red	7600 3759

Other accessories

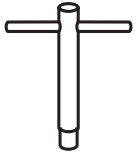
- Reading harp 7600 0938
- Reading spiral 7500 1236

For use with the fixed-angle rotor also available:

- fixed-angle rotor 24 x 1.5 / 2 ml 7500 3325
- special cap nut for fixing the rotor
- 10 mm tubular hexagon wrench for tightening the cap nut

The printed documents consist of the delivery notes and this Manual.

cap nut
order no.
70056208



tubular socket wrench
order no.
2036 0072

for your notes

Before use

Where to install the centrifuge

The centrifuge must be operated in a place meeting the following criteria:

- A safety zone of 30 cm around the centrifuge must be maintained. Hazardous materials must not be kept within this zone during centrifugation.
- The substructure must be stable and resonance-free. A good support is provided by a plane laboratory bench or a large laboratory carriage with casters that may be locked.
- To ensure sufficient air circulation, a minimum distance from the wall of 10 cm at the back and of 15 cm on each side must be kept.
- The centrifuge must be protected from heat and direct sunshine.
- The location should be well ventilated.

Mains connection

Make sure that your mains voltage and frequency match the specifications on the instrument.

Removing the transport protection

Turn the instrument on. The display panel shows for about 6 s the routine internal software check sequence. Open the lid by pressing the "open lid" key and remove the transport protection for the rotor.

Check that the rotor moves freely by lightly turning it, and make sure the rotor is tightly screwed on.

for your notes

Operation

Transport and installation

Damage to the centrifuge by jolting!

Transport the centrifuge only in the upright position using the special box provided with the instrument and secure it properly. Place the centrifuge carefully.

Make sure the rotor transport protection has been removed before starting the instrument!

The *Biofuge haemo* is now ready for use.

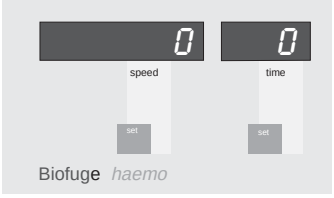
Mains connection

Make sure that your mains voltage and frequency match the specifications on the instrument before connecting the centrifuge to the mains supply.
The instrument does not have a mains switch.

After you have established the mains connection, the following reading appears in the control panel:

This tells you that the instrument carries out an internal check of its software.

If the lid is closed, the display in the panels "speed" and "time" changes to "0" after a couple of seconds:



With opened lid, the "speed" panel displays the message "OPEN" instead.

If you do not intervene, the display changes to the standby mode after 2 minutes. The displays turn dark; however, the centrifuge is ready for use at any time. This is signaled by the flashing red light in the "time" panel.

Opening the lid

Press the "lid" key. The lid lock mechanism is released, and the lid pops open.

Emergency lid release

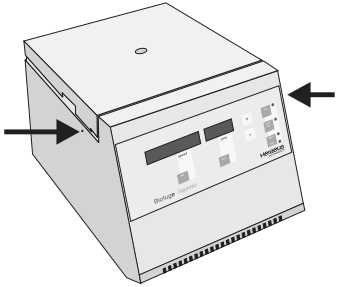
In case of a power failure you cannot open the lid normally using the "lid" key (see previous section). To permit unloading even in this case, the centrifuge is equipped with a mechanical lid unlocking system. However, you may use this system **only** in case of emergency.

Rotor can spin at high speed! Touching it may cause severe injuries!

Always wait for several minutes until the rotor has come to a complete stop. Without power the brake does not function, and braking takes much longer than normal!

Should it be necessary to open the lid manually, carry out the following steps:

1. Make sure the rotor stands still (consult window in the lid).
2. Unplug the mains plug.
3. Push a thin screwdriver or another suitable tool horizontally from each side through the two openings in the side panels of the centrifuge (see figure). Push the locking pins under the side panels simultaneously from both sides until the lid unlocks audibly. Remove the auxiliary tools and open the lid.



4. If the rotor still turns, close lid immediately and wait until it has come to a complete stop

Never brake the rotor using your hands or tools!

5. As soon as the rotor stands still, remove your samples and close the lid.

Loading the hematocrit rotor

After filling and sealing the capillaries, place them into the guide notches with the sealed ends pointing outwards.

The centrifuge must always be loaded weight-symmetrically to avoid unbalance, unsteady runs and subsequent damage.

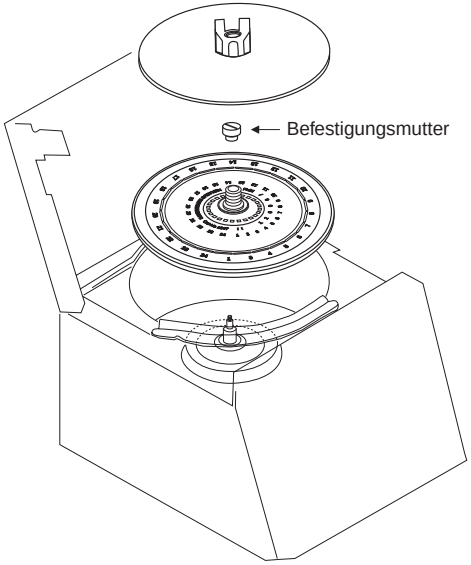
Inserting the hematocrit rotor

After checking for correct loading, you may insert the rotor into the centrifuge.

Possible damage to drive and rotor! Do not push down the rotor by force. If the rotor is tilted, carefully remove and reinsert it.

To put the rotor into position, proceed as follows:

1. Open the lid and make sure that the rotor chamber is clean. Remove eventual dust, foreign material or sample residues.
2. Turn the rotor so that the driving pin of the motor shaft fits into the groove on the underside of the rotor, and slide the rotor onto the drive shaft until the rotor hub rests on the shaft (cf. Figure).



3. Tighten the fastening nut clockwise using a coin.
4. Screw the rotor cap on with the plastic knob.

You must fasten the rotor cap before starting the centrifuge.

Starting and stopping the centrifuge is described starting on page 31, evaluation of the haematocrit on page 36.

Removing the hematocrit rotor
For removing the hematocrit rotor you must carry out the steps described above under "Inserting the hematocrit rotor" in reverse order.

Irreparable damage to the motor! Never tilt the rotor during removal.

1. Open the centrifuge lid.
2. Unscrew and remove the rotor cap.
3. Loosen the rotor fastening nut counterclockwise using a coin. Grab the rotor centrally at the hub and pull out perpendicularly. **Do not tilt.**

The following description applies only to the fixed-angle rotor 7500 3325. If you use the centrifuge only for hematocrit measurements, you may skip this section and continue on page 29 ("Selecting the speed").

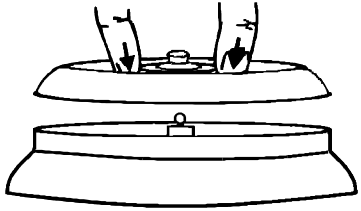
Important application information for rotor 7500 3325 !

To attach the rotor, use the acorn nut with ball head! (Order no. 70056208)

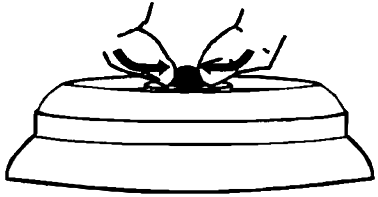
To tighten the acorn nut, use the 10 mm tubular hexagon box spanner. (Order no. 20360072)

Please always close your microlitre containers carefully. Open container lids can damage the rotor lid.
For some special applications the container lids must remain unsealed. If this is the case, please use the screw top (order no. 75003326) instead of the standard snap-on lid (order no. 70901111).

A) Position the snap-on lid.
Press the rotor lid down onto the rotor until the snap-on catch engages onto the ball of the acorn nut.



B) Remove the snap-on lid.
By activating the grip cap, the lock is released and the rotor lid can be removed.



Inserting the rotor

Possible damage to drive and rotor!

You may insert the rotor only if the temperature of the drive, the rotor and the cap nut is between 10 °C and 30 °C.

The rotor approved for the *Biofuge haemo* is shown in the chapter "Accessories". Check whether the rotor you want to insert corresponds to the figure in this chapter.
To insert the rotor, you need the rotor, the cap nut and the tubular socket wrench supplied (see chapter "Accessories – pieces delivered").

Possible damage to drive and rotor!

Do not push down the rotor by force. If you cannot screw on the cap nut easily, remove the rotor and reinsert it.

To put the rotor into position, proceed as follows

1. Open the lid and make sure that the rotor chamber is clean. Remove eventual dust, foreign material or sample residues. The thread and the O-ring on the motor shaft must be in perfect condition.
2. Turn the rotor so that the notch for engaging the drive shaft points downward.
3. Place the rotor on top of the drive shaft so that the notch of the rotor is located precisely above the retaining pin.
4. Push the rotor gently down until the thread is completely laid bare (see figure).

5. If you have placed the rotor correctly, you can screw on the cap nut easily and secure it with the tubular socket wrench delivered with the instrument.
6. Snap the rotor cap onto the rotor (the optional hermetic lid 7500 3326 is screwed on centrally with the lid nut).

Regularly check the proper positioning of the rotor and re-tighten the cap nut as needed.

Permissible rotor temperature

The rotor 7500 3325 may be used only within a temperature range of –4 °C to +40 °C. Pre-cooling in the freezer is not permitted.

Lifetime of the rotor

There are no restrictions to the service life of the high performance rotor 7500 3325 B. However please observe the following due to safety reasons:

Rotors and accessories made of plastic should not be exposed to direct sunlight and UV rays!

If the rotor shows signs of discoloration, deformation or wear, or is out of balance it must be exchanged straight away!

Removing the rotor

To remove the rotor, you must follow the steps described above in reverse order.
With the hermetic lid, you may in case of contamination separate the rotor from the drive without opening the lid! In this case you can open rotor upon removal from the centrifuge using e.g. a safety work bench before decontaminating it.

Danger of irreparable motor damage!

Never tilt the rotor. Always grab it in the middle and pull out perpendicularly.

1. Open the lid of the centrifuge.
2. Remove rotor cap (not necessary with the hermetic lid).
3. Screw the cap nut open by turning it counterclockwise using the socket wrench delivered with the instrument. Remove the cap nut.
4. Grab the rotor in the middle and pull gently upwards off the drive shaft. Be careful not to jam it.

Loading the rotor

As an accessory, you can optionally order the fixed-angle rotor 7500 3325 with 24 places. Three sets of adapters and a hermetic lid are available for this rotor (see under "Accessories").

Improper or improperly combined accessories may cause severe damage to the centrifuge!

Use only the parts and accessories listed in the chapter "Accessories".

Maximum loading

Overloading may cause the rotor to explode! Exploding parts may severely damage the centrifuge!

Never exceed the maximum permissible load of 4 g per place.

The *Biofuge haemo* can reach high rotational speeds implying enormous centrifugal force. The rotor is designed in a way warranting sufficient residual strength even at the highest permissible speed.
However, this safety system presupposes that the maximum permissible load of the rotor is not exceeded.
The maximum load for the rotor has been calculated for a sample density of 1,2 g · cm^{-3}. If the density of your sample is higher, you must either reduce its volume (to an overall weight of 4 g) or calculate a reduced speed n_{perm} according to the following formula:

$$n_{perm} = n_{max} * \sqrt{\frac{weight\ of\ tube\ with\ sample\ 1{,}2\,g * cm^{-3}}{weight\ of\ tube\ with\ denser\ sample}}$$

Filling the tubes

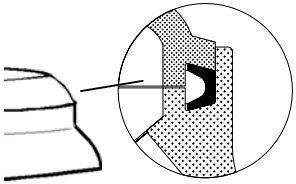
Separations by centrifugation function best when the unbalance of the rotor is minimized because separated zones are not perturbed by vibration. It is therefore important to balance the centrifuge tubes as well as possible.
To minimize unbalance you should fill the tubes as evenly as possible. You can achieve this by eye. However, you must nonetheless ensure that opposite tubes are filled to the same level.

Aerosol-tight application

only with screw-on top 75003326 and not with open container lids!

The following steps have to be carried out:

- Lubricate the seals before inserting them (lubricant order no. 75003500)
- Insert the seal (C profile) in the groove at the side of the body of the rotor.
- Insert the O-ring into the inner groove on the screw-on top.



Attention :
Please check that your sample containers are suitable for the centrifugal application desired.

(16060 x g ; temperature in uncooled devices approx. 10 K above room temperature)

Please observe the permissible filling volumes!

Nominal volume:		Permissible volume:
2.0 ml	-	1.5 ml
1.5 ml	-	1.0 ml
others	-	$^{2}/_{3}$ nominal volume

The sealing elements are to be checked regularly for damage to the shape and surface!
Exchange faulty parts immediately (spare sealing rings 75003268)

The snap-on lid is not suitable for aerosol-tight application!

Checking for aerosol tightness

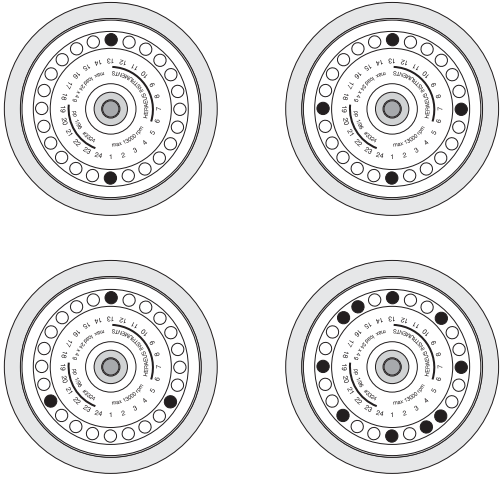
Check the aerosol tightness of your rotor whenever appropriate.

To carry out the test, proceed as follows:

- Carefully clean and degrease the rotor chamber wall, then attach an adhesive white paper strip (about 4 x 2 cm) so that liquid leaking out of the rotor may precipitate on it.
- Fill all places of the respective rotor with water according to the following Table. Insert the rotor into the centrifuge and fasten it.
- Carefully place the amount of test liquid (0.5 % sodium fluorescein in water) specified in the column “leakage test” into the lower part of the rotor within a virtual circle comprising the vessel bores (not the bores themselves) using a pipette or syringe.
- Place the rotor lid on top and screw it on. **ATTENTION:** Make sure that there is no spilled test liquid on the rotor (clean if necessary)!
- Carry out a test run for 10 minutes at maximum rotor speed and 23 °C ambient temperature.
- Check the paper strip under UV light (preferentially in a darkened room):
  If there is no detectable fluorescence, the test is considered passed.
- Finally rinse rotor, rotor lid and lid seal in running water and allow to dry.

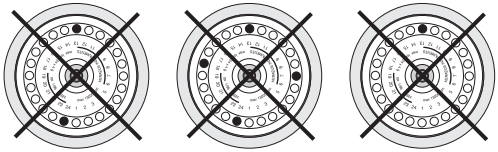
Placing the tubes in the rotor

The rotor must be loaded symmetrically. When loading the rotor only partially, you must ensure that opposite bores always receive tubes of equal weight (when centrifuging a single sample, place a centrifuge tube e.g. filled with water). The following figure gives examples for proper loading.



properly loaded rotors

Improper loading can in the worst case lead to damage to rotor and centrifuge. Unbalance not only causes a noisy run, but rapidly damages the motor suspension.



improperly loaded rotors

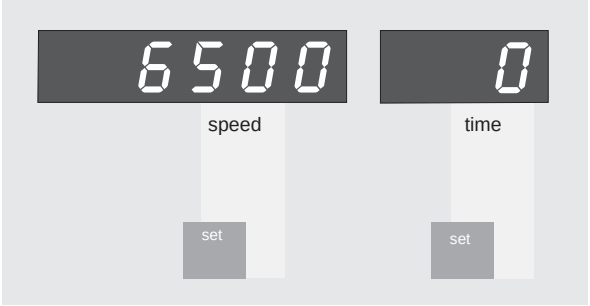
After loading the rotor, snap on the rotor cap until it locks into place. The optional hermetic lid 75003326 is screwed onto the rotor with the central nut. Close the lid of the centrifuge by firmly pressing it down. There must be a clicking sound, and the lid must be locked so that it cannot be opened manually.

Selecting the speed

For hematocrit measurements the speed is limited to maximally 12 000 rpm!

The minimum speed of the drive is 1,600 rpm, the maximum speed 13,000 rpm. The built-in microprocessor prevents higher or lower speed settings. Between these extremes, you can select the speed in steps of 100 rpm using the following procedure:

1. Press the "set" key in the "speed" panel (press twice if the centrifuge is in the standby mode). The speed last entered appears in the display. The third digit from the right (in the example the figure "5") flashes, thus indicating that you can change the setting in multiples of 100 rpm.
2. Press one of the "set" keys "+" (for an increase) or "-" (for a decrease). By pressing the selected key **briefly**, you increase or decrease the speed in steps of 100 rpm. This option is supposed to be used for small changes and fine tuning.
3. If you keep the key pressed, the display changes at first slowly and after a few seconds at an accelerated pace.



4. Release the key as soon as you are close to the desired value, and fine tune if necessary by repeatedly pressing the selected key (or its counterpart if you have proceeded too far in one direction). The third digit from the right keeps flashing. The speed is stored by again pressing one of the "set" keys or "start".

Selecting the run time

You can select a run time between 1 and 99 min or continuous operation.

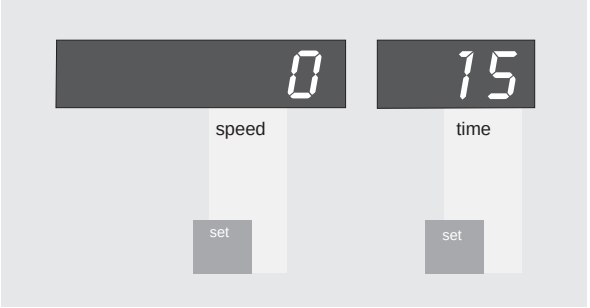
For hematocrit determinations you should select a run time of 10 min for a standard blood column of about 65 mm.

The evaluation of hematocrit measurements is detailed on page 35.

Preselected run time

To predetermine the run time, proceed as follows:

1. Press the "set" key in the "time" panel (press twice if the centrifuge is in the standby mode). The run time last entered appears in the display. The right-hand digit (in the example on the following page the figure "5") flashes, thus indicating that you can change the setting in minutes.
2. Press one of the "set" keys "+" (increase) or "-" (decrease). By pressing the selected key **briefly**, you increase or decrease the preset run time in steps of 1 min. This option is supposed to be used for small changes and fine tuning.
3. If you keep the key pressed, the display changes at first slowly and after a few seconds at an accelerated pace.



4. Release the key as soon as you are close to the desired value and fine tune if necessary by repeatedly pressing the selected key (or its counterpart if you have proceeded too far). The display keeps flashing. The run time is stored by again pressing one of the "set" keys or "start".

Continuous operation

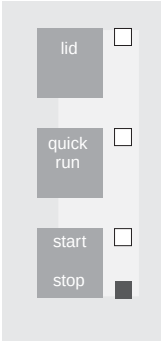
For continuous operation, press the "set" key in the "time" panel and then the "-" key until "hd" (for "hold") appears in the display.

With this setting, the centrifuge keeps running until stopped manually.

Please note that the lifetime of centrifuge tubes, particularly plastic ones, is limited, and that they may be damaged by continuous operation!

Starting the centrifuge

Once the rotor is in place and the lid closed, you can start the centrifuge.

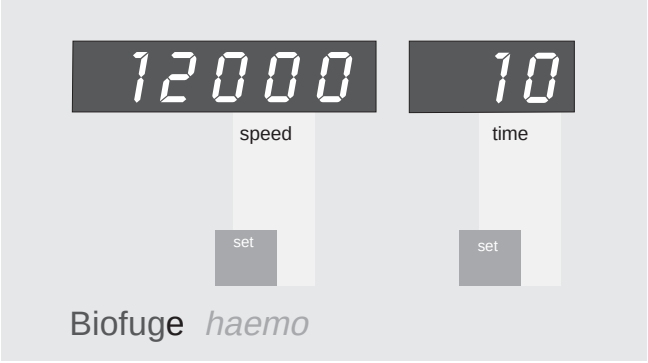


This is signalled by the lit green LEDs to the right of the keys "quick run" and "start/stop" (see Figure). If you are not sure which values you have preselected, you can determine them by pressing one of the "set" keys. The function not currently selected displays "0" irrespective of the actual setting.

Press the "start/stop" key in the control panel. The display panel shows the preselected values for speed and run time (see Figure below). The centrifuge accelerates to the preselected value. Simultaneously, the run time display starts going backward from the preset time, giving the remaining run time in minutes. After reaching the last minute the display switches to seconds remaining.

If you have chosen continuous operation, the time display goes forward instead of backward.

After startup, alle LEDs except the red one for "stop" turn dark. This is now the only function available.



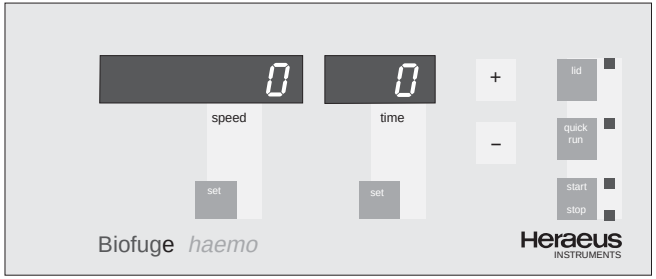
Changing the settings during the run

You can increase the speed setting for the current run by pressing "set" in the "speed" panel, adjusting the value with the "+" key and again pressing "set". If you use the same procedure to lower the speed (by pressing "-" instead of "+"), the centrifuge brakes to standstill and then accelerates again to the newly selected speed.

Likewise you can alter the preset run time during a run by pressing consecutively "set" in the "time" panel, "+" or "-" and again "set".

Displaying the preset values

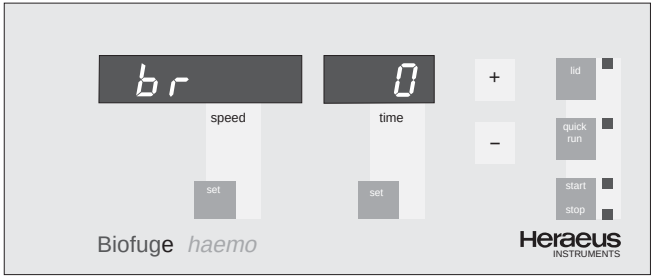
You can check the preset values for speed and run time by pressing one of the "set" keys. If you press the key again, the display turns dark.



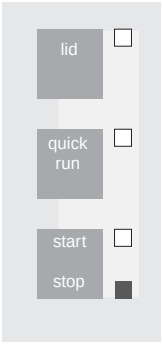
Stopping the centrifuge

Stopping with preset time

Normally the run time has been preselected, and all you have to do is wait until the centrifuge terminates the run automatically. During braking, the "speed" panel reads "br" and the "time" panel "0":



Shortly before the rotor stops, a two-step acoustic signal alerts you to the fact.



As soon as the rotor stands still, both panels display the message "0", and the LED next to the "lid" key lights up.

By pressing the "lid" key, you can now open the lid and remove your samples. The "speed" panel displays "OPEN". After 2 minutes the instrument switches to the standby mode, and all displays turn dark. You can even now open the lid by pressing the "lid" key.
You can stop the centrifuge at any time by pressing the "stop" key.

Stopping with continuous operation
If you have chosen continuous operation, you must stop the centrifuge manually by pressing the "stop" key. The centrifuge starts braking at once and stops within a few seconds. The displays and options are the same as described in the previous section.

Short-time centrifugation

For short-term operation, the *Biofuge haemo* is equipped with a "quick run" function.
This option is available whenever the LED next to the "quick run" key is lit.

The preset speed is ignored! Centrifuge tubes and rotor may be damaged!

Check carefully whether you have to maintain a specific speed.

Never use this option for hematocrit measurements!

When you press and hold the "quick run" key, the centrifuge accelerates with full power up to the maximum speed of 13,000 rpm unless you release the key. The preset speed is ignored.
During acceleration the time is counted forward in seconds. After 60 seconds the display changes to the minute mode.

The "quick run" mode is not recommended for sensitive samples with fluffy sediment.

RCF value

The **r**elative **c**entrifugal **f**orce (RCF) is usually given in multiples of the earth gravity *g*. It is a dimensionless number that allows one to compare the efficiency of separation or sedimentation of diverse instruments, since it is independent of the instrument used. The only values entered in the equation are radius and speed of centrifugation:

$$RCF = 11.18 * \left(\frac{n}{1000}\right)^2 * r$$

r = radius of centrifugation in cm
n = speed in rpm

The centrifuge reaches an RCF value of 16,060 at the maximum speed of 13,000 min^{-1}! Check carefully whether your tubes are designed for such a strain, and reduce the speed if necessary.

The maximum RCF value refers to the maximum radius of the tube.
For the fixed-angle rotor 7500 3325 the above formula yields for the bottom of the bore (radius 8.5 cm) a maximum RCF value of 16,060:

$$RZB = 11.18 * \left(\frac{13{,}000}{1000}\right)^2 * 8.5 = 16{,}060$$

Please note that this value becomes lower depending on the tubes and adapters used.

You may take this into account when calculating the RCF value for your application.
The figure on the last page of this manual gives a graphic representation of the relation between speed and RCF.
Apart from the maximum RCF value RCF_{max} (lower line) this graph also shows the minimum RCF value RCF_{min}, calculated for the meniscus of the sample (upper line).

Measuring the hematocrit value

The hematocrit value is determined after removal of the rotor cap (see page 20). There are two evaluation methods: reading harp and reading spiral.

Reading harp

The reading harp is the standard accessory delivered with the centrifuge. To read the hematocrit values, you must remove the capillaries one by one from the hematocrit dish.

Place the capillary with the lower end of the blood column on the zero line and the upper end on the 100 % line of the reading harp. At the boundary between the erythrocytes and the plasma you can now read the percentage of packed cells. Be careful to place the the capillary at right angles to the zero line.

Reading spiral

The reading spiral is available as additional accessory. To measure hematocrit values, remove the rotor cap (see page 20) and place the spiral on the hematocrit dish, which may remain in the centrifuge. Using the outer knurled (eccentric) screw, turn the zero line so that it comes to lie on the outer end of the blood column; then place the 100 % line of the reading spiral over the meniscus using the knurled screw in the middle.

You can now read the hematocrit value directly from above on the graduation. Once you are finished, you can dispose of all capillaries at once. Loosen the rotor fastening screw with a coin by turning it counterclockwise, lift the hematocrit dish vertically out of the centrifuge and eject the capillaries into the waste disposal by overturning the dish.

General hints concerning hematocrit measurements

A certain amount of standardization is necessary to obtain reproducible results, both in the interest of the patients and blood donors and for the sake of comparability of sciencific data.

The German standard DIN 58933 describes a practical standard. The procedure outlined in this manual has been designed in accordance with this standard. We recommend all users to obtain a copy of it.

for your notes

Maintenance and care

Maintenance to be performed by the customer

For the protection of persons, environment and material you are obliged to clean the centrifuge regularly and to disinfect it if necessary.

Unsuitable cleaning agents or disinfection procedures may damage the centrifuge and its accessories!

If you intend to use cleaning agents or disinfection procedures not recommended by the manufacturer, you have to make sure by consulting the manufacturer, that the procedure foreseen does not cause any damages to the instrument!

Cleaning

Pull mains plug before cleaning the instrument!

Clean the casing, the rotor chamber, the rotor and the accessories regularly and in case of need. This is indicated both for reasons of hygiene and to prevent corrosion due to contamination sticking to the instrument and its accessories.
Clean them with mild agents of pH values ranging from 6 to 8.

For other cleaning agents please consult KENDRO Services!

Immediately after cleaning, dry the aluminum parts or put them into a warm-air dryer at a temperature not exceeding 50°C.

During cleaning liquids and especially organic solvents should not come into contact with the drive shaft and the ball bearing.

Organic solvents may decompose the lubricant of the motor bearing. The drive shaft may block.

Disinfection

If a centrifuge tube containing infectious material leaks during a run, you have to disinfect the centrifuge immediately.

Infectious material could enter the centrifuge if spills or tube breakage occur.

Danger of infection may occur upon contact! Take appropriate protective measures for personnel!

Mind the permissible filling volumes and loading limits for the tubes!

In case of contamination the operator has to make sure, that no further persons are jeopardized!

Contaminated parts have to be decontaminated immediately.

If required further protective measures have to be initiated.

Rotor and rotor chamber must be treated with a neutral, universal disinfectant. Best suited for this purpose are disinfectant sprays, ensuring that all rotor and accessory surfaces are covered evenly.

- Please use 70% ethanol for disinfection.

Please note the safety measures and handling hints when applying these substances!

For other disinfectants please consult KENDRO Services!

- You may disinfect the rotor and the accessories as described in the following section. Be sure to follow the pertinent safety procedures for handling infectious material.

1. Pull mains plug.
2. Unscrew the rotor chuck.
3. Grab the rotor with both hands and pull it perpendicularly off the drive shaft.
4. Remove the centrifuge tubes and adapters, and disinfect them or dispose of them as necessary.
5. Treat the rotor and the rotor lid according to the instructions given for the disinfectant (soaking in liquid or spraying). You must strictly observe the specified action times!
6. Turn the rotor head down and drain off the disinfectant. Thereafter thoroughly rinse rotor and lid with water.
7. Dispose of the disinfectant according to valid regulations.
8. Aluminum rotors have to be treated with anticorrosive protective oil subsequently.

Disinfection with bleaching lye

These agents contain highly aggressive hypochlorites and must not be used with aluminum rotors!

To protect the rotor 75003325 as far as possible you must take the following precautions:

1. Avoid high temperatures!
   The bleaching solution and the rotor should not be warmer than ca. 25 °C.
2. Do not let the bleaching solution act longer than absolutely necessary!
3. After disinfection, rinse the rotor thoroughly with distilled water and allow to dry.

Decontamination

For general radioactive decontamination, use a solution of equal parts of 70% ethanol, 10% SDS and water. Follow this with ethanol rinses, then de-ionized water rinses, and dry with a soft absorbent cloth.

Dispose of all washing solutions in appropriate radioactive waste containers!

Autoclaving

Check whether autoclaving is permitted!

You may autoclave the rotor and the adapters at 121 °C.
Maximum permissible autoclaving cycle:
20 min at 121 °C.

For reasons of safety you may autoclave the rotor 7500 3325 maximally 10 times!

The rotor must be cleaned and rinsed with distilled water before being autoclaved. Remove the rotor lid, the centrifuge tubes and the adapters. Place plastic rotors on an even surface to avoid deformation.

Chemical additives to the steam are not permitted.

Never exceed the maximum permissible values for autoclaving temperature and autoclaving time.

Should the rotor show signs of wear, you must stop using it!

The KENDRO service offer

Kendro Laboratory Products recommends annual servicing of the centrifuge and the accessories by authorized customer service or trained professionals. The customer service personnel is inspecting:

- the electrical installations
- the suitability of the location
- the lid lock mechanism and the safety circuit
- the rotor
- the rotor fastening and the drive shaft

Defective material is exchanged.
KENDRO offers inspection and service contracts covering it. Inspection costs are charged as flat-rate contracts.

Necessary repairs are carried out free of cost within the warranty conditions, and against payment after expiration of the warranty period.

Warranty conditions

The warranty period starts with the day of delivery. Within the warranty period the centrifuge is repaired or replaced free of cost if there are provable faults in materials or workmanship.
Conditions for a warranty are:

- the centrifuge is used according to the instructions of use
- mounting, extensions, settings, alterations or repairs are carried out exclusively by personnel authorized by KENDRO
- the required maintenance and care procedures are carried out regularly.

Troubleshooting

Problems you can handle yourself

If problems other than those described in the following tables arise, you must consult your nearest authorized service.

Error	Behavior of the centrifuge	Possible cause(s) and measures to be taken
Displays remain dark	The motor stops. The rotor stops without braking. The lid cannot be opened.	**Mains failure or not connected** 1. Check the mains connection. 2. If the mains connection is OK, call the nearest Service.
Displays fail briefly	The motor stops suddenly. The rotor stops without braking. The display reads "br", see br.	**Brief interruption of mains supply** 1. Check whether the plug is plugged in properly. 2. Restart the centrifuge.
Lid cannot be opened	Pressing the "lid" key has no effect.	**Lid not correctly engaged or lid warped.** Press lid down in the middle of the front section. **Heat monitoring relays in the lid unlocking magnets have been actuated** (repeated pressing of the "lid" key within a few seconds). Press key again after a short pause (approx. 1 min).

Error	Behavior of the centrifuge	Possible cause(s) and measures to be taken
	Centrifuge is exceptionally noisy.	1. Stop the centrifuge by pressing the "stop" key, in case of emergency pull mains plug. 2. Wait until the centrifuge stands still. 3. Check whether the rotor is properly loaded. 4. Check whether a broken vessel, damage to the rotor or motor malfunction was responsible for the noise. 5. If you cannot locate and solve the problem, call Service.
br	Mains connection interrupted during run	If the plug was pulled inadvertently, plug in again. Wait for about 75 seconds. The centrifuge comes to a stop without braking.
E-1 or E-12	Rotor does not start	Pull mains plug and plug in again. If the error persists, call Service.
E-3	No braking current; drive out of order, rotor stops without braking	**Lid opened during run.** Wait until the rotor has come to a complete stop (check window in the lid). Pull mains plug and plug in again. If error persists, call nearest Service. **Motor overheated.** Room temperature too high or insufficient air cooling. Pull mains plug and wait 30 min. Check all vents and clean with small brush.

Error	Behavior of the centrifuge	Possible cause(s) and measures to be taken
"Lid" appears in the display	Motor stops. Rotor stops without braking.	Lid lock mechanism out of order 1. Press the lid shut. The centrifuge stops without braking. 2. If error persists, call nearest Service.
Display "OPEN“ appears although lid is closed	Start impossible	Control lid lock mechanism. The lock must be engaged on both sides. If error persists, call nearest Service.
Flashing red point in "time" panel	Displays remain dark Not an error; instrument is on standby	Press any key. With "start/stop" or "quick run", the centrifuge starts running at once. With the "lid" key, the lid pops open, and the display reads "OPEN".

In case you must call the Service

Should you require our Service, please tell us the order no. and serial number of the instrument. You find the pertinent information at the back of the instrument near the socket for the mains plug.

Technical data

Component parts and performance

Part / function	Description
Design	**Armored case:** steel **Frame**: torsion resistant, hot galvanized 4-mm steel plates **Body and front panel**: impact-resistant, highly dampening plastic **Lid**: stove-enameled steel plate
Keys and display panel	Keys and display panel covered with easy care protective foil
Rotor chamber	Material: impact resistant plastic Dimensions (diameter x height): 222 mm x 110 mm
Lid release	Electromagnetic release with "lid" key when connected to mains
Lid lock	Automatic locking when the lid is pressed shut
Emergency lid release	Lid release in case of power failure: emergency opening with auxiliary tool.

Part / function	Description
Start	"start/stop"-key
Stop	"start/stop"-key
Short-term start and stop, respectively	„Quick run“-key : short-term run when pressed permanently; stop when released
Indication of operating state	Preset values for speed and run time ar displayed during the run.
End of centrifugation	The panels "speed" and "time" read "0".
parameter memory, parameter display	• speed • run time
Speed selection	adjustable in steps of 100 min^{-1} in the range of 1600 min^{-1} to 13000 min^{-1}
Run time selection	adjustable in minutes from 1 min to 99 min; „hd“-mode: continuous operation
Time display in „quick run“ mode	between 1 s and 60 s in seconds, over 1 min in minutes
diagnostics	• lid not properly closed: display "OPEN"; • indication of general malfunctions (ERROR codes)

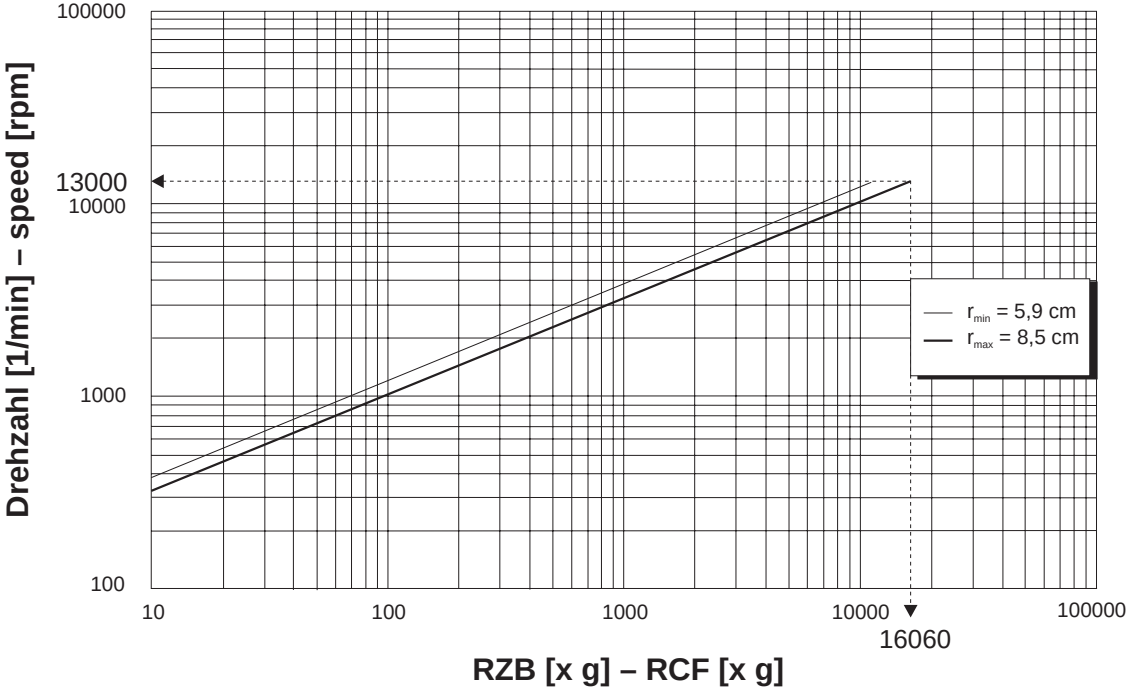
Parameter	Value/description
environmental conditions	- indoor use - max. elevation 2000 m above sea level - max. relative humidity 80 % up to 31 °C; linearly decreasing down to 50 % relative humidity at 40 °C.
admissible temperature of the environ ment	4 °C to 35 °C during operation -10 °C to 50 °C during storage and transport
dimensions	240 mm x 284 mm x 375 mm (H x W x D)
weight without rotor	14.5 kg
maximum speed	13,000 rpm (hematocrit rotor 12,000 rpm)
maximum RCF value	16,060 (fixed-angle rotor) 14,926 (hematocrit rotor)
minimum speed	1600 rpm
minimum RCF value	209
noise	<64 dB (A)
maximum capacity	24 x 2 ml
maximum permissible load	24 x 4 g
maximum permissible unbalance	1 g

Parameter	Value/description
maximum kinetic energy	2.000 kNm
compliance with standards	Manufactured and checked in accordance with EN 61 010-1, EN 61 010-2-020, EN 50 081-1, EN 50 082-1.

Electrical connections/fuses

Order no..	Voltage	Frequency	max. current	Power consumption	Fuses inside instrument *
# 7500 3635	230 V	50/60 Hz	1.25 A	170 W	2 x 6.3 AT (5 x 20 mm)
# 7500 3557	120 V	50/60 Hz	2.5 A	170 W	2 x 6.25 AT (6.3 x 32 mm) 1 x 10 AT (6.3 x 32 mm)

Speed / *g* diagram for rotor 7500 3325



Autoclaving protocol
(only fixed-angle rotor 7500 3325)

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1				
2				
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